UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,265	07/07/2003	Ming-Huang Kuo	ACMP0056USA	1264

27765   7590   01/03/2007

NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
P.O. BOX 506
MERRIFIELD, VA 22116

EXAMINER
HUNG, YUBIN

ART UNIT	PAPER NUMBER
2624	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

PTOL-90A (Rev. 10/06)

	Application No.	Applicant(s)
Office Action Summary	10/604,265	KUO, MING-HUANG
	Examiner	**Art Unit**	
	Yubin Hung	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>*07 July 2003*</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date <u>9/5/03</u>.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Specification

1.   The disclosure is objected to because of the following informalities:

- Claim 1: per figure 1, the recited steps are executed sequentially, with the output of a step (starting from the decomposing step) being the input of the step immediately below it; as written, the intended result is not guaranteed

- Claim 3, line 1: "whereinresizing" should have been "wherein resizing"

- Claim 7, line 1: per Fig. 2, refs. 106 and 108 "after decomposing" should have been "before decomposing"

Appropriate correction is required.

[Note: Per communications with applicant's representative Mr. Scott Margo dated December 13 and 17, 2006, for examination purpose claims 1-13 will be interpreted as per Appendix A.]

Claim Rejections - 35 USC § 103

2.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3.   Claims 1-6, 9-11 and 13 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Kraske (US 5,841,890), and further in view of Chern et al.

("Difference Wavelet—Theory and A Comparison Study," Methods and Applications of

Analysis, Vol. 9, No. 4, pp. 469-492, December 2002) and Akhan et al. (US 7,085,436).

Regarding claim 1, Kraske discloses a method that

- loading the image into an image processing program
  [Fig. 9, refs. 100 & 282 and Col. 11, lines 28-30. Note that the process implementing Fig. 9, ref. 282 (the decomposition process) is considered a program. Note further that loading of the image to the program is inherent]
- decomposing the image using wavelet
  [Ref. 282 (wavelet decomposing) of both Figs. 9 & 11; Col. 11, lines 26-44 and Col. 11, line 66-Col. 12, line 4]
- reconstructing the image using wavelet
  [Fig. 9, refs. 208-214 (wavelet subimages); Fig. 13 (reconstruction); Col. 11, 41-44; Col. 12, line 59-Col. 13, line 19]
- outputting the image
  [Fig. 13, ref. 251. Note the reconstructed image is output from ref. 252]

Kraske does expressly disclose that the wavelet scheme used is difference wavelet nor

the following

- truncating the image below a predetermined threshold level or enhancing the image according to an enhancement function

However, Chern discloses using difference wavelet [1st paragraph of the abstract and

section 2] and Akhan discloses thresholding (i.e., truncating) wavelet coefficients (i.e.,

the image) to reduce the size of the image [Col. 4, lines 12-15].

Kraske, Chern and Akhan are combinable because they all have aspects that are from

the same field of wavelet transform.

At the time of the invention it would have been obvious to one of ordinary skill in the art

to modify Kraske with the teachings of Chern and Akhan by using difference wavelet as

well as truncating the resultant wavelet coefficients. The motivation would have been to

possess fast algorithms (for implementation) and to have fast decay (as Chern indicates

in lines 3-6 of the abstract), as well as to reduce the size of the image (as Akhan

indicates in Col. 4, lines 10-11).

Therefore it would have been obvious to combine Chern and Akhan with Kraske to

obtain the invention as specified in claim 1.

4.   Regarding claims 2 and 3, Kraske further discloses (claim 2) re-sizing an original

dimension of the image [Fig. 11, ref. 292 (re-sizing before loading into wavelet transform

282) and Col. 12, lines 9-14] and (claim 3) that the new dimension is $2^k m \times 2^k n$ with k

being the level of decomposition [Fig. 11, ref. 292 and Col. 12, lines 9-14; note that any

dimension M x N can be expressed as $2^d m \times 2^d n$ for some d $>= 0$ and further note that

Fig. 12 shows that at each successive decomposition level the image is down-scaled by

a factor of 2 in each dimension, with the upper-left component being the one that is

subject to another level of decomposition].

5.   Regarding claim 4, Kraske further discloses a decomposition process comprising

- performing a decomposition process of each row of the image
  [Fig. 9, ref. 101a (horizontal, or row, decomposition); Col. 11, lines 28-44; see also Figs. 6 & 10]
- performing a matrix transpose operation on the image
  [Fig. 9, ref. 103a (transpose); Col. 11, lines 28-44; see also Fig. 10]
- performing another decomposition process of each row of the image
  [Fig. 9, ref. 101b & 101c (another horizontal, or row, decomposition); Col. 11, lines 28-44; see also Fig. 10]

6.   Regarding claim 5, Kraske further discloses a reconstruction process comprising

- performing a reconstruction process of each row of the image
  [Fig. 13, ref. 101b & 101c (horizontal, or row, reconstruction); Col. 13, lines 10-19]
- performing a matrix transpose operation on the image
  [Fig. 13, ref. 103a (transpose); Col. 13, lines 10-19]
- performing another reconstruction process of each row of the image
  [Fig. 13, ref. 252 (another horizontal, or row, reconstruction); Col. 13, lines 10-19]

7.   Regarding claim 6, Kraske further discloses resizing the image back to its original

dimension [Fig. 13; Col. 12, lines 59-63 (reconstruction by reversing the decomposition

process); note that since in claim 2 image is re-scaled in one way, the reversal of the

process will re-scale in the opposite direction and therefore recovers the original

dimension].

8.   Regarding claim 9, the combined invention of Kraske, Chern and Akhan further

discloses

- wherein the truncation process is performed line by line on the image
  [Note that per the analysis of claim 4, wavelet coefficients are the result of the second row-by-row (i.e., line-by-line) decomposition process and the coefficients are subsequently truncated as per the analysis of claim 1, it would have been obvious to one of ordinary skill in the art to truncate a coefficient as soon as it is available, and this will result in line-by-line truncation. The motivation for doing so would have been to improve efficiency by reducing memory access since the coefficients need not be stored away and later accessed again in order to perform truncation]

9.   Regarding claim 10, Chern further discloses

- wherein the difference wavelet used for decomposition and reconstruction has a filter bank corresponding to average values and a filter bank corresponding to fluctuation values [P. 472, section 2.1: equation 2.1 (averaging filter bank) and equation 2.2 (fluctuation filter bank)]

10.   Regarding claim 11, Chern further discloses

- wherein parameters of the difference wavelet used for decomposition and reconstruction are (r, rt) = (1, 3), where r represents an average parameter and rt represents a fluctuation parameter [P. 472, the line under equation 2.5 indicates the sum of r, the averaging order (i.e., parameter) and $\tilde{r}$ (i.e., rt), the differencing order (i.e., fluctuation parameter) is 2K. Since the testing results for difference wavelet (Diff) shown in tables 5 (P. 480) & 6 (P. 481) indicates that r = 1 gives the most efficient method (see the two lines above Table 5) and in table 11 (P. 485) indicates that K = 2 (implying rt = 2K – r = 3 when r = 1) produces the best regularity, they strongly teach using (1, 3) for (r, rt) to obtain the best efficiency and regularity]

11.   Regarding claim 13, Akhan further discloses

- wherein both truncating the image below the predetermined threshold level and enhancing the image according to the enhancement function are performed after decomposing the image using the difference wavelet [Col. 4, lines 10-20 (truncating after decomposing). Note that per the parent claim (claim 1) enhancing need not be performed *in addition to* truncating. In any event, it is well known in the art that truncating the coefficients can reduce noise, which is a form of enhancement; for example, see Col. 5, lines 15-17 of Quadranti et al. (US 6,594,391)]

******

12.   Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraske (US 5,841,890), Chern et al. ("Difference Wavelet—Theory and A Comparison Study," Methods and Applications of Analysis, Vol. 9, No. 4, pp. 469-492, December 2002) and Akhan et al. (US 7,085,436) as applied to claims 1-6, 9-11 and 13 above, and further in view of Goertzen (US 2003/0142875).

13.   Regarding claim 7, the combined invention of Kraske, Chern and Akhan discloses all limitations of its parent, claim 1 but not expressly the following:

- wherein before decomposing the image using the difference wavelet the method further comprises performing an RGB (red-green-blue) to YUV (luminance-bandwidth-chrominance) transformation

However, Goertzen discloses applying RGB-to-YUV transform [Fig. 10, ref. 604 and paragraph 62, lines 10-13] before decomposition [Fig. 10, ref. 616 and paragraph 62, lines 26-31].

The combined invention of Kraske, Chern and Akhan is combinable with Goertzen because they both have aspects that are from the same field of endeavor of wavelet transform.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Kraske, Chern and Akhan with the teachings of Goertzen as recited above. The motivation would have been because the YUV representation reduces the inter-color axis correlation intrinsic to the RGB color space, as is well known in the art [for example, see lines 7-10, paragraph 23 of Banerji et al. (US 2003/0012278)].

Therefore it would have been obvious to combine Goertzen with Kraske, Chern and Akhan to obtain the invention as specified in claim 7.

14.   Regarding claim 8, the Kraske further discloses performing a YUV to RGB transformation after reconstruction (if RGB → YUB was performed during

decomposition) [Fig. 13 and Col. 12, lines 1-5 (reconstruction by reversing the decomposition process); note that since in claim 7 RGB is transformed to YUV, the reversal of the process shall include a YUV → RGB transformation].

******

15.   Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kraske (US 5,841,890), Chern et al. ("Difference Wavelet—Theory and A Comparison Study," Methods and Applications of Analysis, Vol. 9, No. 4, pp. 469-492, December 2002) and Akhan et al. (US 7,085,436) as applied to claims 1-6, 9-11 and 13 above, and further in view of Bradley (US 5,710,835).

Regarding claim 12, the combined invention of Kraske, Chern and Akhan discloses all limitations of its parent, claim 1, but not expressly the following:

- wherein the reconstruction process is performed by using periodic boundary conditions

However, Bradley discloses using a periodic boundary condition in the reconstruction process [Fig. 1 and Col. 5, lines 51-59. Note that the synthesis part corresponds to reconstruction].

The combined invention of Kraske, Chern and Akhan is combinable with Bradley because they both have aspects that are from the same field of endeavor of wavelet transform.

At the time of the invention it would have been obvious to one of ordinary skill in the art

to modify the combined invention of Kraske, Chern and Akhan with the teachings of

Bradley by using periodic boundary condition in the reconstruction process. The

motivation would have been because the input to a wavelet process is assumed to be of

infinite duration and for input of a finite length, periodic boundary condition is used to

effect infinite duration, as Bradley indicates in column 5, lines 51-59.

Therefore it would have been obvious to combine Bradley with Kraske, Chern and

Akhan to obtain the invention as specified in claim 12.

Conclusion and Contact Information

16.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure:

- Quadranti et al. (US 6,594391) – discloses a wavelet transform application that

  thresholds wavelet coefficients to reduce noise [Col. 5]

- Banerji et al. (US 2003/0012278) – discloses a compression method that

  converts RGB to YUV to reduces correlation of the RGB color axis [Paragraph

  23]

- Brechner (US 6,944,332) – discloses a wavelet transform application that

  converts color space and truncates wavelet coefficients [Fig. 4 & Col. 6]

- Li et al. (US 6,898,313) – discloses a method that effects wavelet transform by averaging and differencing and quantizes the resultant coefficients [Figs. 6-12 & columns 10-12]
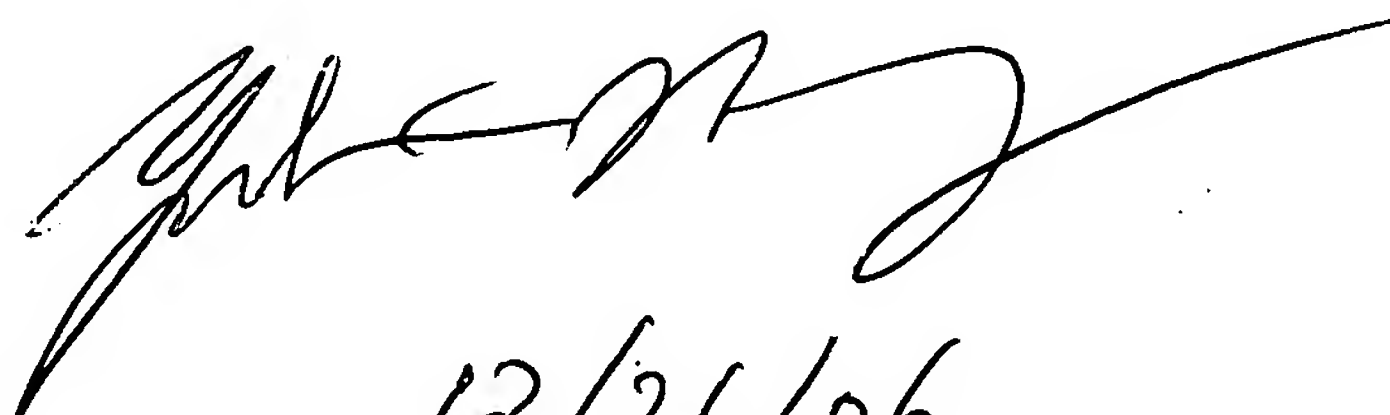
17.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Yubin Hung
Patent Examiner
Art Unit 2624
December 21, 2006

12/26/06

APPENDIX A: Claims 1-13 as interpreted

1. (Currently amended) A method of processing an image using a difference wavelet, the method comprising:

loading [[the]] a first image into an image processing program to produce a second image;

decomposing the second image using the difference wavelet to produce a third image;

truncating the third image below a predetermined threshold level or enhancing the third image according to an enhancement function to produce a fourth image;

reconstructing the fourth image using the difference wavelet to produce a fifth image; and

outputting the fifth image to produce a sixth image.

2. The method of claim 1 wherein loading the first image into an image processing program comprises the step of resizing an original dimension of the first image to produce the second image.

3. The method of claim 2 wherein resizing the original dimension of the first image comprises resizing the first image to have a new dimension of a (2^km x 2^kn) matrix for producing the second image, wherein m and n are positive integers and k represents a level of decomposition and reconstruction.

4. The method of claim 3 wherein decomposing the second image using the difference wavelet comprises performing a decomposition process of each row of the second image to produce a decomposed image, performing a matrix transpose

operation on the <u>decomposed</u> image <u>to produce a first transposed image,</u> and performing another decomposition process of each row of the <u>first transposed</u> image <u>to produce the third image.</u>

5. The method of claim 3 wherein reconstructing the <u>fourth</u> image using the difference wavelet comprises performing a reconstruction process of each row of the <u>fourth</u> image <u>to produce a reconstructed image,</u> performing a matrix transpose operation on the <u>reconstructed</u> image <u>to produce a second transposed image,</u> and performing another reconstruction process of each row of the <u>second transposed</u> image <u>to produce the fifth image.</u>

6. The method of claim 3 wherein outputting the <u>fifth</u> image comprises resizing the <u>fifth</u> image back to <u>the dimensions of the first image</u> ~~its original dimension~~.

7. The method of claim 1 wherein ~~after~~ <u>before</u> decomposing the <u>second</u> image using the difference wavelet<u>,</u> the method further comprises performing an RGB (red-green-blue) to YUV (luminance-bandwidth-chrominance) transformation <u>to produce the third image.</u>

8. The method of claim 7 wherein after reconstructing the <u>fourth</u> image using the difference wavelet<u>,</u> the method further comprises performing a YUV to RGB transformation <u>to produce the fifth image.</u>

9. The method of claim 1 wherein the truncation process is performed line by line on the <u>third</u> image.

10. The method of claim 1 wherein the difference wavelet used for decomposition and reconstruction has a filter bank corresponding to average <u>image</u> values and a filter bank corresponding to <u>image</u> fluctuation values.

11. The method of claim 10 wherein parameters of the difference wavelet used for decomposition and reconstruction are (r, rt) = $(1, 3)$, where r represents an average parameter and rt represents a fluctuation parameter.

12. The method of claim 1 wherein the reconstruction process is performed by using periodic boundary conditions.

13. The method of claim 1 wherein both truncating the <u>third</u> image below the predetermined threshold level and enhancing the <u>third</u> image according to the enhancement function are performed after decomposing the <u>second</u> image using the difference wavelet.